Federal Aviation Administration's

# R&D Review

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## A Year of Success!

### *A Message from Joan Bauerlein Director of Operations Planning Research & Development*

In 2003, as the world celebrated the 100th anniversary of Orville and Wilbur Wright's first flight, the next generation of aviation researchers forged ahead to ensure the safety and efficiency of the next 100 years of flight. In 1903, our greatest research challenge was the ability to master powered flight. One hundred years later, our greatest research accomplishments span the globe.

**"In 1903, our greatest research challenge was the ability to master powered flight. One hundred years later, our greatest research accomplishments span the globe."**

Because of the work of our researchers and our partners, critical new R&D products are improving aviation. In particular, I would like to thank Dr. Herman Rediess, my predeccessor as director, for his leadership in creating a strong, productive, and globally recognized research program.

As we end 2003, the FAA's R&D community has a lot to celebrate, and I would like to take this opportunity to share some of our successes.

Since, space precludes me from highlighting all of our accomplishments, I encourage you to visit our website at, http://research.faa.gov, where we will soon post our 2003 R&D Annual Report.

For several years the FAA's research and development office, has been advocating the need for innovative new concepts to meet the nation's air transportation system needs of the future. Jointly with NASA, we established the Federal Transportation Advisory Group (FTAG), which produced *Vision 2050: An Integrated Transportation System*, and the Aerospace Transportation Advisory Group (ATAG), which produced a paper describing the next generation air transportation system. We also jointly sponsored the National Research Council Aeronautics and Space Engineering Board (ASEB) to assess independently the FTAG and ATAG reports and recommend enabling technology and research for the future aviation system. They published the report, *Securing the Future of U.S. Air Transportation - A System in Peril*, in November, 2003. Several of our senior researchers devoted over a year to supporting the

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## Inside this Issue:

## Critical Research for Aviation's Future

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If you are a researcher from industry, academia, or government and would like to submit any FAA research-related articles/photographs for future publication in the R&D Review, or to be added to the R&D Review mailing list, please contact:

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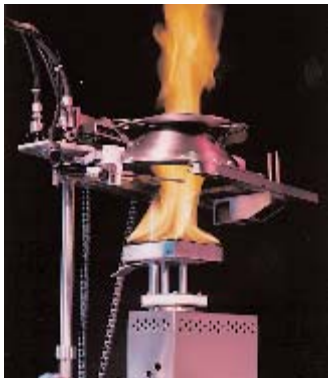
### A Year of Success - *continued from page 1*



Presidential Commission on the Future of the United States Aerospace Industry. Both the ASEB and Commission reports called for establishing a national program to transform the future air transportation system.

In Fiscal Year (FY) 2003, a Joint Planning & Development Office (JPDO) was established involving the Department of Transportation, FAA, NASA, Department of Defense, Department of Homeland Security, Department of Commerce, and the Office of Science and Technology Policy. The Office of Operations Planning Research & Development continues to be a strong advocate for and supporter of the JPDO, which is to develop a National Plan for the Transformation of Air Transportation (see article on page 4). As you will read in the following pages, FAA's researchers remain steadfastly committed to conducting critical research for the near- and long-term future of aviation.

FAA's researchers continue to make great safety advances for today's system. In response to industry's challenge to develop a practical and reliable fuel tank inerting system to prevent fuel tank explosions, FAA's researchers succeeded in developing such a prototype. In the summer of 2003, the FAA and Airbus conducted flight tests of this inerting system in an A320 aircraft in Toulouse, France. Data from these tests is being used to enhance the inerting system's design. Also, in July 2003, Boeing began a flight test program to certify an onboard inert gas generating system based on the FAA design. FAA supported these tests with instrumentation (as described in *A Description and Analysis of the FAA Onboard Oxygen Analysis System*, http://research.faa.gov/aar/tech/docs/techreport/FY2003/DOTFAAARTN 0352.pdf). Boeing announced its intent to begin installing these systems on its 747 aircraft in FY 2005. (See article on page 11.)

As a result of FAA flammability tests of aircraft thermal acoustic insulation, the FAA adopted new flammability test standards for the thermal acoustic insulation used in transport airplanes. The standards include new flammability tests for in-flight fire ignition resistance and postcrash fire burnthrough resistance. These standards will improve aircraft safety by reducing the incidence and severity of cabin fires by delaying the entry of postcrash fires into the cabin, thereby allowing passengers more time for evacuation. To establish the new flammability test method, FAA researchers created a new test apparatus comprised of two main components: a large burner that simulates a jet fuel fire and a sample holder representative of the fuselage structure. The FAA's new test method, called the radiant panel test, subjects a material heated by a radiant panel to a pilot flame. The pass/fail criteria require that any flaming not extend beyond a 2-inch length from the point of flame application or continue flaming after removal of the pilot flame.

Loss of control data indicates that 40 percent of accidents include a propulsion malfunction in the chain of events that lead to a crash. The FAA initial-

ly established flight deck instrumentation requirements for piston engine airplanes. Those requirements now need to be reassessed as turbine engines mature into highly reliable and complex power plants. Hence, researchers are reviewing the current data presented to the pilot and are examining the value of that data to identify when the data is used, what limits are in place for its use, and the expected pilot response to an out of range value.

As part of this work, researchers evaluated new technologies that can take the propulsion system data currently available to the pilot via cockpit gauges and create a means to turn that information into communications that direct the crew to the proper procedure when action is required. Currently, propulsion engineers, flight deck engineers, and human factors specialists are taking a global look at propulsion indicators in the cockpit to understand how pilots become aware of engine malfunctions. Researchers are categorizing the malfunctions and phase of flight to develop a set of potential alerts that can address the various malfunctions. Analysis of events and real event data indicate that technology to provide indications in a meaningful amount of time to aid the pilot is feasible.

Most atmospheric aircraft icing is a result of super cooled liquid droplets freezing on aircraft surfaces. Many clouds, however, contain both super cooled droplets and ice particles. The National Transportation Safety Board has recommended that the FAA examine whether or not aircraft icing certification requirements should be expanded to include mixed-phase icing conditions. Since there is only limited scientific information available on mixed phase icing conditions, FAA researchers are undertaking the necessary work to assess whether or not certification requirements should be changed.

In recent tests using a wing section equipped with a thermal ice protection system, FAA researchers, in collaboration with Wichita State University, Cox & Company, and NASA Glenn Research Center scientists, made great strides in understanding super cooled droplets by discovering that in mixed-phase icing conditions super cooled water droplets present in the mixed-phase cloud cause ice accretion. For glaze ice, which occurs at temperatures close to 32°F, the ice particles in the mixed-phase clouds actually reduce the overall size of the ice accretion. This may be due to shedding or splashing of water from a surface water film resulting from ice particles bouncing in the film, and, less likely, to erosion of accreted ice by the incoming particles.

The performance of the thermal ice protection system, when used in an evaporative mode, did not seem to be adversely affected by the presence of ice particles in the cloud. However, testing the system in a running wet mode indicated that the power requirements at the leading edge are much higher when ice particles are present in the simulated cloud.

The FAA's Aviation Weather Research Program made significant contributions to the safety of the national airspace system by working collaboratively with industry, government, and academia to improve aviation weather forecasting abilities.

For example, in FY 2003 the National Weather Service's Graphical Turbulence Guidance product went into operational use. This automated software product provides a color forecast of turbulence at any user-selected flight level above 20,000 feet. The Current Icing Potential for Alaska product also went into operational use. This product graphically depicts areas of icing at user-selected flight levels in Alaska and is a variation of the already operational Current Icing Potential product.

The FAA also installed the Weather Support to De-icing Decision Making system at Denver International Airport. This system tracks and predicts snow accumulation so that operators can make better decisions regarding deicing fluids and the times in which aircraft deicing must be repeated so that runway plowing can be done more efficiently. (See article on page 16.)

In FY 2003, the FAA, in collaboration with the Volpe National Transportation Systems Center, the Massachusetts Institute of Technology, and the Logistics Management Institute, developed a unique capability to estimate aircraft emissions ranging from a single flight to regional and worldwide scales.

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# For the National Good

## *Transforming the U.S. National Air Transportation System*

The FAA is currently working with the Department of Transportation, NASA, Department of Defense, Department of Homeland Security, and Department of Commerce to plan for the future air transportation system - a system that will offer the flying public greater choice, lower prices, and fewer delays.

FAA's John Kern, Executive Director of the Joint Planning & Development Office, explains that this multi-agency effort is working for the national good, ensuring the United States maintains its global aviation leadership. "This collaborative activity, which will result in the *National Plan for the Transformation of Air Transportation*, represents a unified commitment to shape the policy and research necessary to make certain our air transportation system results in more jobs, a strong economy, and a more positive balance of trade," explains Kern.

The future aviation system will not resemble the system we know today. Aircraft will cost less to fly, will be more fuel efficient, will operate on shorter runways, will be far superior technologically, and will include many unmanned vehicles. Increased market liberalization, the addition of new airports in the United States and abroad, and improved operations procedures will enable these aircraft to serve new markets and customers. In addition to handling increased operations, airports will be more integrated with other modes of transportation and provide more sophisticated security measures.

Such changes will lead to new business models and investment strategies that will, in turn, drive the aviation industry of the future.

**Our Vision: A transformed aviation system that allows all communities to participate in the global marketplace, provides services tailored to individual customer needs, and accommodates seamless civil and military operations.**

"To support our nation's economic growth and viability," explains Kern, "the United States must have an aviation system that can fully respond to the changing needs of businesses and customers." When fully transformed, the future air transportation system will:

- Enhance economic growth and create jobs;
- Expand system flexibility and deliver greater capacity;
- Tailor services to customer needs;
- Integrate capabilities to ensure national defense;
- Promote aviation safety and environmental steward ship; and
- Retain U.S. leadership and economic competitiveness in global aviation.

The benefits to aviation - increased mobility, higher productivity, and greater efficiency - will be fully realized through the introduction of new technologies and procedures, innovative policies, and more advanced management practices. As a result, the United States will have a system capable of moving more people and goods safely, quickly, and effectively.

Kern calls the Joint Planning & Development Office an experiment in government. "We are transforming the way government organizations coordinate activities to advance national goals in a cost-effective and timely manner." The team is creating a roadmap that takes advantage of individual departmental strengths so policy and technology issues can be managed to enhance innovation and rapid implementation.

For example, the Department of Transportation will ensure the necessary policy changes, while the FAA will provide the infrastructure and the necessary procedural and operational changes. NASA has the lead to align research and develop common operational requirements. The Department of Commerce is leading the effort to produce a collaborative weather research program. Homeland Security heads the effort to ensure a high degree of security that remains transparent to air travelers. The Defense Department is providing insight to future concepts, such as unmanned air vehicles.

Currently the team is:

- Developing a unified vision of the future air transportation system;
- Conducting a socio-economic demand study;
- Constructing, with industry, future scenarios for the economic, societal, safety, and security value of air transportation;
- Determining, with the air transportation community, how people, products, and procedures will work together to achieve a seamless, efficient air transportation system; and
- Identifying strategies and R&D needs to facilitate the transformation to the future.

Through its cooperative, interagency work, the Joint Planning & Development Office is sending a strong signal to industry that the Federal Government is committed to fostering a strong U.S. air transportation industrial base. Industry, academia, and state and local governments are being asked to help develop the National Plan. "New ideas are always welcome," says Kern. "For the Joint Planning & Development Office to reach its critical goals, we need input from all sectors of the aviation community." To get more information on the Joint Planning & Development Office's work, please contact John Kern at john.kern@faa.gov. ■

# New REDAC Chair

## *Hamre Named to Head Key Advisory Committee*

FAA Administrator Marion C. Blakey, recently announced that John J. Hamre, President and Chief Executive Officer of the Center for Strategic and International Studies (CSIS), has been selected to serve a two-year term as chairman of the FAA's Research, Engineering and Development Advisory Committee (REDAC.)

Known for his experience and deep background in a broad range of defense, congressional, and security issues, Hamre has served in several top-level positions at the Department of Defense, was a professional staff member for the Senate Armed Services Committee, and was a deputy assistant director for national security and international affairs at the Congressional Budget Office before moving to CSIS in January 2000. Hamre also served as a member of the Commission on the Future of the U.S. Aerospace Industry.

"John's counsel will be particularly invaluable as we move forward with performance-based management and increased accountability at the FAA," said Administrator Blakey. "His proven expertise in procurement, research and development, and federal budget issues will help steer the committee through the new challenges of a new century of flight."

The REDAC, established in 1989, advises the FAA Administrator on research and development issues and coordinates the FAA's research, engineering, and development activities with industry and other government agencies. The committee considers aviation research needs in air traffic services, airport technology, aircraft safety, aviation security, human factors, and environment and energy.

A maximum of 30 members may serve on the Committee, representing corporations, universities, associations, consumers, and government agencies. All members serve two-year terms. The FAA's Director of Aviation Research, serves as the executive director of the committee.

Hamre is considered an expert on DOD, the congressional authorization and appropriation processes, missile defense, export control reform, and cybersecurity. As Under Secretary of Defense (Comptroller) from 1993 to 1997, Hamre was the principal assistant to the Secretary for preparation and execution of defense budget and management improvement programs. Hamre then served as Deputy Secretary of Defense from 1997 to 1999.

Hamre received a Ph.D. with distinction from the School of Advanced International Studies at Johns Hopkins University and a B.A. with distinction from Augustana College in South Dakota. He also studied as a Rockefeller Fellow at the Harvard Divinity School. ■

# Perspective

## *Carl Burleson Talks About the CAEP*

The Director of FAA's Office of Environment and Energy (AEE), Carl Burleson, recently talked with *R&D Review* about the Agency's role in the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP).

**Q: How are environmental concerns affecting aviation?**

A: Environmental issues are likely to impose a limit on air transportation growth in the 21st century. The 2000 U.S. General Accounting Office (GAO) study on airport noise notes that in a survey of airport officials, 29 of 50 believed aircraft noise remained their most serious environmental issue, which constrains future airport development.

Besides continuing concerns over aircraft noise, aviation emissions are a growing source of local air quality and health worries, and, of course, a growing concern to airports. The recently released GAO survey on emissions found that while aviation sources remain a very small percentage of transportation emissions, local worries about the environmental impact of these emissions could impede capacity growth. About 25 percent of U.S. commercial service airports are in areas that are in nonattainment or maintenance for national ambient air quality standards - including 43 of the top 50 airports. Airports located in air quality nonattainment or maintenance areas find that air emissions add to the complexity, length, and uncertainty of the environmental review and approval of expansion projects. Europe and parts of Asia are experiencing similar issues.

Recent studies also show that airports across Europe are, or likely will be, subject to growth constraints resulting from environmental impacts.

**Q: What do you see as the role of the United States in the development of international standards relating to aircraft noise and engine emissions?**

A: Aviation is a global industry, and, as such, it is important that we set aviation environmental standards in an international context. The U.S. plays a critical role in developing aircraft noise and engine emissions standards in this international context. ICAO is the only internationally recognized body charged with setting environmental standards for civil aviation.

ICAO environmental standards subsequently serve as the basis for national aircraft noise standards adopted by FAA and emissions standards promulgated by the Environmental Protection Agency. Through active participation in ICAO's Committee on Aviation Environmental Protection, we seek to arrive at international standards based on the best available technical and economic data and to ensure we adopt responsive and effective mitigation strategies.

**Q: Describe your role within ICAO's Committee on Aviation Environmental Protection and what you see as the key issues of the next CAEP?**

A: The ICAO Council established CAEP as a specialized technical committee in 1988 to develop environmental standards for both noise and emissions. CAEP comprises 19 member states, Australia, Brazil, Canada, Egypt, France, Germany, Italy, Japan, Netherlands, Poland, Russian Federation, Singapore, South Africa, Spain, Sweden, Switzerland, Tunisia, United Kingdom, and the United States. I am the U.S.'s CAEP member, and, as such, take the lead representing U.S. policies and interests at the triennial CAEP plenary meeting, as well as at the yearly CAEP Steering Committee meetings.

The next CAEP plenary meeting, its sixth, will take place in February, 2004, in Montreal, Canada. CAEP 6 will address a number of noise issues, including "Balanced Approach" guidance and implementation. This approach will mitigate aircraft noise impact via a shared approach, with air carriers operating quieter aircraft, airports providing good planning and local environmental measures, air traffic service providers facilitating noise abatement procedures, and local governments ensuring proper land-use around airports).

However, the most challenging discussions will be emissions related as we seek to establish a new nitrogen oxides (NOx) stringency standard and evaluate how several market based approaches, voluntary agreements, charges, and emissions trading, should be further developed to address aviation's carbon dioxide ($CO_2$) emissions. Note, though, that CAEP is an advisory body. CAEP members will develop

recommendations for ICAO council/assembly consideration/action. ICAO's 35th assembly, which will take place in September or October 2004, will consider and act on any environmental recommendations resulting from CAEP 6.

**Q: How has the AEE research program helped with your CAEP work and how do you expect it to help in the future?**

A: The AEE research, engineering, and development program (RE&D) has played, and will continue to play a critical role in FAA's CAEP activities. Simply put, we could not do our job in CAEP without our RE&D investment. The environment RE&D program supports the FAA role in the CAEP working groups for assessing the technological, scientific, and economic aspects associated with maintaining international standards and recommended practices for aircraft noise and engine exhaust emissions.

**Q: Would you please describe to our readers just some of your program's accomplishments that have supported CAEP?**

A: Our core competency is noise and emissions analytical tools that provide local and global noise contours and exposure and emissions contours and inventories. The tools were developed and advanced through our R,E&D investments. Our Integrated Noise Model (INM) is the pre-eminent tool used by CAEP member states to assess noise exposure around airport communities. The Emission and Dispersion Modeling System (EDMS) and Model for Assessing Global Exposure from Noise of Transport Airplanes (MAGENTA) tools have also played key roles in assessing proposed actions.

**Q: What are your expectations for the new Center of Excellence (COE) as it relates to CAEP?**

A: The new Center, called PARTNER (Partnership for AiR Transportation Noise and Emissions Reduction) will conduct basic research to identify and better measure the issues and impacts associated with aircraft noise and aviation emissions, and generate improved solutions to deal with these problems. The knowledge and capability gained from this research will provide critical information to decisionmakers, including CAEP members, to tackle environmental impacts.

An international approach in framing actions to deal with aircraft noise and emissions issues encourages harmony in rulemaking. Therefore, international collaboration is another key theme of PARTNER. Rolls-Royce is one of our industry partners and the FAA is exploring a partnership with Transport Canada through the Center. The FAA also welcomes quid-pro-quo partnerships with other nations to stimulate and enhance PARTNER research.

**Q: With fiscal year 2004 just beginning, what are your expectations for the research program this year - and what does it mean to your CAEP work?**

A: Fiscal year 2004 is a critical year for us. It is a transition year for our analytical program from stand alone noise and emissions efforts, to an integrated approach. Noise and emissions are interdependent, but we lack the analytical tools to assess these interdependencies. These limitations inhibit FAA's ability to provide continued leadership in CAEP. One of the FAA's Flight Plan's major environmental initiatives, which the Administrator has greatly supported, is to conduct research and develop analytical tools to understand better the relationship between noise and emissions and amongst different types of emissions. In fiscal year 2004 we will scope the content of these tools and prepare a comprehensive work plan, with the help and advice of the Transportation Research Board. This will position us to start developing a seamless, comprehensive set of tools to address all aspects of noise and emissions in Fiscal Year 2005.

Our goal is for these tools to assist CAEP in establishing programs and policies that maximize environmental benefits. Secondly, though we started several COE projects in fiscal year 2003, 2004 is really our first full year operating the Center. One of the projects which will impact the CAEP work program is an effort by Pennsylvania State University, Stanford University, Boeing, Gulfstream, and Wyle Laboratories to study supersonic transport sonic boom and annoyance.

The objectives of this study are to assess applicability of existing noise metrics to sonic boom and to determine annoyance of low boom waveforms. The findings will help inform future decisionmaking on supersonic flight over land and inform CAEP as it considers standards for supersonic aircraft. Overall, I am very excited about the future of FAA's environmental RE&D program and its role in supporting future CAEP efforts. ■

# FAA Researcher Featured in New Book

## Fireproofing an Aircraft Cabin

The recently released *Handbook of Building Materials for Fire Protection* (NY: McGraw-Hill Professional, 2004) features a chapter written by the FAA's Dr. Richard E. Lyon. This is the first handbook entirely devoted to the coverage of building materials in the field of fire engineering.

Dr. Lyon's chapter focuses on plastics and rubber. Plastics' combination of low cost, flexibility, and strength make them popular as building and aircraft cabin materials. Many plastics, comprised primarily of carbon and hydrogen, burn easily.

The book provides information on the burning characteristics of a variety of building materials that can be used by fire protection engineers to design fire safe buildings and public transportation.

As editor Charles A. Harper writes in the book's preface, "While always important, the broad field of fire protection has, in recent years, appropriately received ever increasing attention. Higher concentrations of people and buildings, wider use of materials in processing, more critical and costly equipment and systems all contribute to the need for greater understanding and control of fire protection in materials, systems, and fabrication and processing operations."

Dr. Lyon is internationally known for his fire research. As FAA's program manager for fire research, he directs a long-range program in fire resistant materials and conducts applied research in flammability and combustion of polymeric materials. Based on Dr. Lyon's research, by 2007 the FAA hopes to be able to increase the fire resistance of plane interiors by a factor of ten. This translates into ten extra minutes for passengers to exit a burning plane.

As Dr. Lyon explains, "Airplane cabins consist mostly of plastics or polymers. Because of the heightened dangers of fire in a cabin surrounded by jet fuel, much of the FAA's fire research has focused on materials for aircraft seats, walls, and carpets." Dr. Lyon's long-term goal is to achieve a completely fireproof cabin.

Before coming to the FAA, Dr. Lyon worked as a research engineer and project manager in the Chemistry & Materials Science Department at Lawrence Livermore National Laboratory, Livermore, CA. He holds a B.S. in Chemistry and an M.S. and Ph.D. in Polymer Science & Engineering from the University of Massachusetts. He has over 40 journal publications and book chapters, 3 patents, and is published in scores of conference proceedings on polymer chemistry, mechanics, and flammability. ■

# The Human Factors Design Standard

## Getting Better All the Time

The FAA recently released its new *Human Factors Design Standard*. This comprehensive human factors reference incorporates best practices and information from a broad range of human factors sources, including government, industry, and academia.

The *Standard* replaces and expands upon the *Human Factors Design Guide* published in 1996. It includes both air traffic and airway facilities systems, providing a common source of FAA-specific design requirements. The resulting set of standards can be tailored to meet the needs of any system or program.

"Although created for the FAA, the *Standard* and its predecessor publication have had a broad impact within and outside of the FAA," states Mark Rodgers, FAA's Program Director, Human Factors Research and Engineering Division. With over 100 new rules and guidelines and a reorganization of material based on information from users, the *Human Factors Design Standard* presents information in the form of "should" and "shall" statements. These statements can be easily converted into system-specific requirements documents or checklists.

The *Standard* is now available for download through the internet at, http://hf.tc.faa.gov/hfds/, or in CD ROM format by sending a request to: vicki.ahlstrom@faa.gov. ■

# Aging Aircraft Conference

## *Sharing Knowledge and Ideas*

Keynote speaker
Dr. Chris Smith, FAA

The 7th Annual Joint Conference on Aging Aircraft held in New Orleans in September provided an important forum for those concerned about the nation's aging aircraft fleet to share ideas, learn about current research, and strengthen partnerships. Over 700 leaders from government, academia, and the aviation industry gathered at this symposium to discuss vital concerns, such as structures and damage tolerance, crack detection, wiring, engines and subsystems, fatigue, corrosion, and monitoring.

Dan Salvano, FAA's Director of the Office of Communications, Navigation, and Surveillance, pointed out the importance of the conference, stating that there are approximately 6,000 large commercial aircraft in service with approximately 20 million annual departures and 35 million annual flight hours. The relatively long service histories of many aircraft in the nation's commercial fleets, combined with high replacement costs, pose significant challenges to those responsible for providing reliable and safe operations.

"A well-maintained airframe could remain airworthy indefinitely, explained Dr. Chris Smith, manager of the FAA's Aging Aircraft Research and Development Program. "So the question then is not 'are our aircraft too old to be flown safely,' but rather 'have we put in place adequate maintenance programs to pre-empt threats associated with chronic structural degradation?'"

FAA researchers, working together with manufacturers and operators, are improving methodologies to predict the onset and growth of widespread fatigue damage. FAA-sponsored research is also steadily advancing the capability of aircraft inspection technology. The ability to find cracks characteristic of widespread fatigue damage or the conditions which herald the onset of that damage will give the FAA and industry an added measure of confidence that our aged aircraft remain free of this insidious threat. As Dr. Smith emphasized, "Because the consequences of even minor imprecision or unreliability can be disastrous, we will refuse to release any product that has not been fully tested and validated - whether it be a methodology for determining residual strength or a device for finding cracks."

**"A well-maintained airframe could remain airworthy indefinitely, so the question then is not 'are our aircraft too old to be flown safely,' but rather 'have we put in place adequate maintenance programs to pre-empt threats associated with chronic structural degradation?'"**

One very important task toward this goal is the destructive evaluation of a retired Boeing 727 aircraft that has reached its design service objective. The FAA and Delta Airlines are working together to understand and document the experimental procedures and analytical methods that constitute a valid destructive evaluation and extended fatigue test of a typical retired aircraft. This is not an attempt to indict the structure of this aircraft, but an effort to develop guidelines for FAA and industry engineers who will rely on data from such teardowns to justify programs to preclude widespread fatigue.

In the process of performing this dry-run, researchers will be able to validate the capability of new and very powerful structural modeling and simulation methodologies. These methodologies, which can predict the nature and criticality of structural fatigue, will be essential tools in our fight to rid aircraft of the threat of widespread fatigue damage. Furthermore, this exercise will give inspection engineers a unique opportunity to evaluate the field capability of emerging nondestructive testing technologies. Without confidence in our ability to detect cracks characteristic of widespread fatigue damage, aircraft maintainers will have to rely on extra-conservative (and perhaps costly) methods to preclude the possibility of widespread fatigue.

Widespread fatigue damage is not the only concern for aging metal. Turbine engine and rotorcraft dynamic components present some more conventional, but still difficult, life management issues. To make damage tolerance work for turbine disks and rotorcraft dynamic components, the FAA is working to understand better how fatigue cracks initiate and grow under conditions unique to these components. With this knowledge, more sensitive and reliable inspection tech-

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# FAA Creates Two New Centers of Excellence

## Centers Target Key Research Areas

The FAA recently announced the creation of two new Air Transportation Centers of Excellence - the Joint Center of Excellence for Advanced Materials and the Partnership for AiR Transportation Noise and Emissions (PARTNER).

The Joint Center of Excellence for Advanced Materials, sponsored by the FAA and NASA, "will help lead America into its second century of aviation excellence," said Secretary of Transportation Norman Mineta when he announced the creation of the new Center. This Center, the first to be jointly sponsored by two Agencies, will focus on safety and certification initiatives relating to existing near- and long-term applications for composites and advanced materials to large transport aircraft. The goal is to ensure safe and reliable use of these new materials in aircraft applications. The Center will play an important role in technology transfer, training, and continuing education for the aircraft industry and regulators.

This consortium of research partners is led by the University of Washington and Wichita State University. Other academic institutions participating in the new center are: Washington State University; Northwestern University; Oregon State University; Purdue University; Tuskegee University; University of California at Los Angeles; University of Delaware; and Edmonds Community College.

The Partnership for AiR Transportation Noise and Emissions Research and development efforts will concentrate on a broad spectrum of noise and emissions mitigation issues, including: socio-economic effect; noise abatement flight procedures; compatible land-use management; airport operational controls; and atmospheric and health effects.


Its affiliated members will identify solutions for existing and anticipated aircraft noise and emissions-related problems. The Center will conduct basic research and engineering development and will develop prototype solutions.

In announcing the new Center, FAA Administrator Marion Blakey explained that PARTNER "is a force to make significant contributions in noise and emissions research." The Massachusetts Institute of Technology (MIT) leads the Center. The other academic members include: Boise State University; Florida International University; Pennsylvania State University; Purdue University; Stanford University; University of Central Florida; and University of Missouri, Rolla.

Congress authorized Air Transport--ation Centers of Excellence under the Federal Aviation Administration Research, Engineering and Development Authorization Act of 1990. This broad legislation enables the FAA to work with universities and their industry partners to conduct research in airspace and airport planning and design, environment and aviation safety, as well as to engage in other activities to assure a safe and efficient air transportation system. Matching funds are provided to the Centers by industry.

In addition to the two new Centers, the FAA has established five other Centers of Excellence, focusing on computational modeling of aircraft structures, airport pavement technology, operations research, airworthiness assurance, and general aviation.

For more information about the FAA Centers of Excellence program, please visit, http:// www.coe.faa.gov or contact Dr. Patricia Watts via email at: pat.watts@faa.gov. ■

# Fuel Tank Inerting System

## *Industry puts FAA-Developed Technology to the Test*

"Every now and then we have a real safety breakthrough, and I think that's what we have here," stated former Director of Aviation Research, Dr. Herman Rediess. The breakthrough is the FAA-developed onboard fuel tank inerting system. "This system, quite simply, prevents fuel tank explosions."

Following the 1996 TWA Flight 800 accident, in which the center fuel tank caught fire, fuel tanks became a critical safety issue. Although jet fuel is less flammable than gasoline, it can explode in combination with high heat, oxygen-laden air, and a spark. With the FAA system, sparks will no longer ignite the fuel vapors, causing an explosion.

The FAA's inerting system fills a fuel tank full with non-flammable nitrogen gas, which makes an explosion all but impossible. Specifically, its dual flow design for generating nitrogen-enriched air in flight creates high-purity/low-flow nitrogen enriched air during ascent and cruise, and lower-purity/high-flow nitrogen enriched air during descent.

FAA inerting system installed in the A320 cargo compartment

The prototype is a low cost alternative to past experimental inerting systems. It uses a simple design of three tubes (for the A-320 only one tube is needed) that extract nitrogen from the air and a series of pipes to carry the nitrogen into the fuel tank. More importantly, it has no moving parts, which means less chance for parts to break or stop working.

FAA and Boeing personnel involved in flight tests of Boeing's fuel tank inerting system

Industry is very excited by the introduction of this new technology. In fact, FAA researchers are supporting both Boeing and Airbus in inerting flight tests of these cutting edge systems. "Successful completion of these tests will bring the system one step closer to deployment throughout the commercial fleet," explained Dr. Rediess, "because nitrogen gas could be a cheaper solution than other options, we believe the aviation industry will embrace this new technology."

Airbus began operational testing of the FAA-developed inerting system in mid-July using an Airbus A320 single aisle medium range airliner. During the Airbus flight tests, researchers measured the oxygen concentration throughout the A320 center wing tank as well as the nitrogen-enriched air and oxygen enriched air generated by the inerting system. Previously, FAA researchers successfully installed and tested this unique inerting system in the FAA's 747SP.

Boeing has designed an inerting system based on the FAA prototype and last summer began certification tests on a Boeing 747. FAA researchers developed and built a unique instrument, the On-Board Oxygen Analysis System, to collect oxygen concentration data that measures the effectiveness of the inerting system. As a result of these tests, the FAA recently issued a notice of proposed special conditions for all the Boeing 747 series airplanes, proposing the performance objectives and additional safety standards for the fuel tank inerting system that Boeing will begin to install in their 747's in 2005. ■

# Meeting Aviation's Challenges

## *3rd Joint Air Transportation Centers of Excellence Meeting*

On November 4-7, the FAA and Embry-Riddle Aeronautical University hosted the Air Transportation Centers of Excellence (COE) 3rd Joint Annual Meeting. Over 250 representatives from government, industry, and academia attended the forum to celebrate COE achievements, discuss current issues, and plan future activities.

In his opening remarks, FAA's former Director of Aviation Research, Dr. Herman Rediess, pointed out that "the Nation needs innovative new approaches to air transportation if we are to resolve" our current challenges. "It will take the combined R&D resources of government, industry, and universities to provide the innovative systems concepts and technology options for the future." Dr. Rediess pointed out that through COE meetings like this "we hope to foster collaborative efforts across Centers . . . learn from others' experiences to improve how we operate . . . and provide a forum" to exchange ideas and explore opportunities.

In her welcoming remarks, Sharon Pinkerton, FAA's Assistant Administrator for Aviation Policy, Planning and Environment, said that the COE program is "a new, innovative way for the FAA to do business." She explained that COEs are important because the Agency needs "collaboration to achieve [its] goals." The Centers help provide answers to questions and are helping to solve problems.

Conference speakers stressed that solutions to today's aviation challenges are a function of innovation and R&D investment. In an era of decreasing resources, partnerships are an essential way to do business. The FAA's five COEs - Aircraft Noise and Aviation Emissions Mitigation, General Aviation, Airworthiness Assurance, Operations Research, Airport Technology - represent significant partnerships, embracing over 100 academic and industry partners. To date, these partners have performed over 350 critical research tasks, representing an investment by the FAA, other agencies, academia, and industry of over $130 million. The resulting research products have made significant advancements in aviation science and in new technologies and procedures.

As Chris Seher, former Manager of FAA's Aircraft and Airport Safety R&D program, said, "the COEs are providing cost-effective solutions and are playing a vital role in transferring innovative safety technologies from research to operations."

John Kern, FAA's senior advisor for strategic planning, asked the COE partners for their help in creating the future air transportation system. Kern, who leads an interagency Joint Planning & Development Office, is developing a national air transportation system transformation plan. He said all "new ideas are welcome," and encouraged participants to "imagine the possibilities" for creating a new aviation system that is agile, scaleable, and balances the objectives of multiple stakeholders. He said that there are no simple solutions - the challenge is to keep the future system safe and robust.

Keynote speaker, Ambassador Edward Stimpson, the U.S. Representative on the ICAO Council, talked about his work on the ICAO Council and how important it is to find well-qualified individuals to fill ICAO slots. He urged the COE partners to help find qualified Americans interested in obtaining exciting international assignments with ICAO.

The conferees all agreed that aviation's future lies, in part, with the COE partners, who are leveraging scarce resources not only to enhance the safety and efficiency of the air transportation system of today and tomorrow but also to train the next generation of aviation professionals.

The 4th Annual Joint COE Meetings will be hosted by Florida International University in Miami with their industry affiliates. Further details will be available on the COE website at, http://www.coe.faa.gov or by contacting COE Program Director, Dr. Patricia Watts at, pat.watts@faa.gov. ■

# COE Student Awards

## Recognizing the Next Generation of Aviation Experts

The FAA recently recognized its student partners in aviation. At the Center of Excellence (COE) conference, students had the opportunity to present their research efforts in either a poster or a paper format.

In the category of best paper, the first place recipient was Avijit Mukherjee, University of California, Berkeley, for his paper entitled, "Role of Optimization Models in Future Air Traffic Management Systems"

Other winners in this category included: Rashmi Keshava Iyengar, Arizona State University, for his paper, "Ethernet Based Aviation Databus - Design Criteria and End System Architecture;" Jonathan Fisher, University of Illinois at Urbana-Champaign, for, "A System Approach to Minimizing Wildlife Hazards to Aircraft;" and Mario Westphal, Embry-Riddle Aeronautical University, for his paper, "Operational Evolution Plan: Implementing Geographic Information System Applications in Aviation"

In the poster category, first place honors went to Shihui Shen, University of Illinois at Urbana Champaign, for her work entitled, "Fatigue Studies in Asphalt Concrete Airport Pavements."

Additional winners in this category included: Alex Apeagyei, University of Illinois at Urbana Champaign, for, "Laboratory Aging of Asphalts Modified with Antioxidants;" Avijit Mukherjee, University of California Berkeley, for his work entitled, "Dynamic Decision Making and Optimization Models in Future Air Traffic Management;" and Arief Rachman, Wichita State University, for, "Experimental Study of SLD Impingement on Ice Shapes."

FAA COE students of the year: included: Jesse Romo, Embry-Riddle Aeronautical University; Daniel Sherman, University of Illinois at Urbana-Champaign; Raymond Stacks, Virginia Polytechnic Institute; and, Lamia Salah, Wichita State University (also recognized as the 2003 DOT student of the year).

The recipient of the 2004 Department of Transportation COE Student of the Year is Bruno Miller, MIT. He received this award for research conducted through the National Center of Excellence for Aviation Operations Research (NEXTOR). Bruno received this honor at a ceremony held in conjunction with the annual Transportation Research Board meeting held January 13. ■

# Research Awards

## FAA Research Earns Industry Kudos

The NASA Growth Analysis Software (NASGRO) team recently received two major awards. The first is an R&D100 Award. *R&D Magazine* presents these awards annually to the 100 most technologically significant new products of the year. An independent panel of technical experts chooses the winners on the basis of their importance, uniqueness, and usefulness.

The team also received the 2003 NASA Software of the Year Award. NASGRO was one of two computer programs honored as the top software in all of NASA following a rigorous evaluation process, including a detailed presentation to the NASA Software Advisory Panel.

NASGRO Fracture Analysis Software is a suite of programs used to analyze crack growth, perform life assessments, compute stresses and stress intensity factors, and process and store fatigue crack growth properties. NASGRO was developed at Johnson Space Center to perform fracture control analysis on NASA space systems. Later, in partnership with the FAA, aviation industry, and other government agencies, it was extended for use in damage tolerance analysis of aircraft.

The FAA's Peter Shyprykevich recently received the "Composite Materials Handbook Distinguished Service Award" for his outstanding contributions to the advancement of the Military Hand-book 17. Started

*continued on page 19*

# 2003 Excellence in Aviation Award

## *FAA Announces Winner*

FAA Administrator Marion Blakey commenced the selection of Professor John-Paul Clarke, of the Massachusetts Institute of Technology's Department of Aeronautics and Astronautics, as the winner of this year's FAA Excellence in Aviation Award.

"The adverse environmental by-products of aviation, primarily noise and emissions, are major constraints on the growth of aviation," said Blakey. "The work of Professor Clarke in modeling and simulation of the environmental impact and in advanced operational procedures that reduce noise impact on local communities will help in reducing some of the constraints."

Professor Clarke is recognized nationally and internationally for his contribution in noise and emissions modeling and for the development of operational procedures to reduce the environmental impact of aviation. His specific accomplishments include:

- Developing a unique simulation and design tool with a 3-D noise propagation module that includes atmospheric effects;
- Developing and quantifying the noise reducing potential of advanced operational procedures;
- Creating a new methodology for developing noise abatement procedures;
- Exerting national leadership by forming and leading the research team that designed and flight-tested a noise abatement procedure that reduced community noise and
- Assisting in development of a system for assessing global emissions.

In addition to his environmental compatibility work, Professor Clarke is also an expert in air traffic management and the design of airline schedules. His Extensible Air Network Simulation (EANS) model allows users to study the impact of different airline and air traffic management strategies and tactics. He has created a model that predicts the market share and revenue potential of global alliances based on an objective metric of schedule convenience.

He is also responsible for the concept of degradable airline scheduling where airlines create itineraries with known reliability, thereby allowing passengers to make their own decision about the amount of delay they are willing to tolerate, improving customer satisfaction and potentially enhancing revenue.

Dr. Clarke has published his research in a number of national and international journals and has received numerous awards for his work. He currently serves as a member of the FAA's Research, Engineering and Development Advisory Committee, the AIAA Air Transportation Systems Technical Committee, and the INFORMS Aviation Applications Section. Most recently, MIT, under Dr. Clark's leadership, has been selected by the FAA to lead a consortium of industry and academic partners in the creation of a new FAA Center of Excellence, the partnership for Air Transportation Noise and Emissions. Center partners will focus efforts on a broad spectrum of noise and emissions mitigation issues.

The highly competitive Excellence in Aviation award is presented annually to individuals and/or institutions whose contributions through research in aviation have resulted in significant improvements to the National Airspace System. Through this award, the FAA formally acknowledges the value of aviation-related research efforts. ■

# Safety Culture

## *5th Workshop on Risk Analysis and Safety Performance in Aviation*

Keynote speaker,
Dr. Nick Pidgeon

At the 5th Workshop on Risk Analysis and Safety Performance in Aviation, held in August 2003, representatives from government, industry, and academia met to discuss system safety risk management philosophies, approaches, models, methodologies, and to share ideas on how to assess potential safety risks and take proactive steps to reduce the rate of aviation-related accidents and incidents.

Keynote speaker, Dr. Nick Pidgeon, Director, Centre for Environmental Risk, University of East Anglia, Norwich, UK, pointed out the critical need for aviation organizations to create a safety culture. He defined a safety culture as a "system of norms, rules, beliefs, attitudes, and social and technical practices within an organization or group concerned with minimizing exposure to conditions considered dangerous." Only by creating a culture where everyone is focused on safety, where everyone is involved in safety, and where everyone is committed to safety will safety be improved. He also talked about a need for a "safety imagination." A culture where everyone plans and trains for the worse case scenario is a culture that prevents accidents.

The approximately 230 national and international participants at this 3-day conference all share the same goal - to stop accidents before they happen by understanding causal factors, identifying trends, examining a variety of data to find patterns, and developing mitigation strategies.

The workshop provided a forum for them to discuss a variety of approaches to system safety and risk management from six different perspectives: general aviation, risk management, human factors, safety performance, safety culture, and operations/maintenance.

FAA summer interns, Diana DeFiore
and Prakie Singh, check in attendees

Linda Sollars,
JetBlue Airways

According to Rosanne Weiss, FAA's workshop coordinator, "effective risk management depends on the use of knowledge and information gained from system models, system performance data, risk, hazard or threat analyses, accident and incident models, and vulnerability analyses. Safety performance measurement is also based on safety critical functions, threats, and defenses identified in these models. This workshop provided a critical forum for those interested in aviation safety to exchange ideas, develop innovative new approaches, and to consider a variety of alternatives for enhancing system safety."

Copies of the conference presentations can be found on-line at, http://aar400.tc.faa.gov/aar424/workshop2003/agenda.htm. Plans are already underway for the 6th Workshop. As details become available, they will be posted on-line at, http://aar400.tc.faa.gov/aar424/. ■

# Ready for Winter

## FAA Research Helps Thaw Aircraft Ground Deicing Challenge

From pilots who fly single-engine Cessnas to those flying jumbo jets for the airlines, icing is one of the most feared and respected weather hazards among aviators. Any commercial airline passenger who has experienced long delays while waiting for their aircraft to be deiced knows that airlines take the deicing process very seriously at the expense of late takeoffs and revised schedules. Due to the catastrophic effects that even a small layer of ice can have on aircraft performance, most seasoned travelers know that any amount of time needed to deice the airplane is well worth the wait.

Even a very thin layer of ice on a wing surface can increase drag and reduce airplane lift by 25 percent. This type of ice accumulation has been a cause or factor in 10 commercial aircraft takeoff accidents between 1978 and 1997. The FAA's Aviation Weather Research Program, in an effort to understand this problem, began supporting ground deicing research in 1991.

The research resulted in development of an integrated display system that depicts accurate, real-time determinations of snowfall rate, temperature, humidity, wind speed, and direction, called the Weather Support to Deicing Decision Making (WSDDM; pronounced "Wisdom") system. The sources of weather data used by WSDDM include Doppler Radar, surface weather stations, and snow gauges located near the airport, which accurately measure the amount of water in the snow. This system has been used operationally at the three major New York airports and at Denver International Airport. An independent assessment estimated the annual benefit of an operational WSDDM system at the New York airports to be $16.7 million.

FAA-funded research at the National Center for Atmospheric Research (NCAR) found that the liquid equivalent snowfall rate is one of the most important factors in determining the holdover times for deicing fluids (time until a fluid fails to protect against ice build up). The reported snowfall rate during 5 of the last 10 accidents was "light" to "moderate" based on the visibility; however, post-accident analysis indicated that the rate, when taking into consideration the liquid water equivalent was most likely "high." Previously, airlines relied on pilot and National Weather Service estimates of snow intensity, both of which rely on prevailing visibility, not liquid water equivalent.

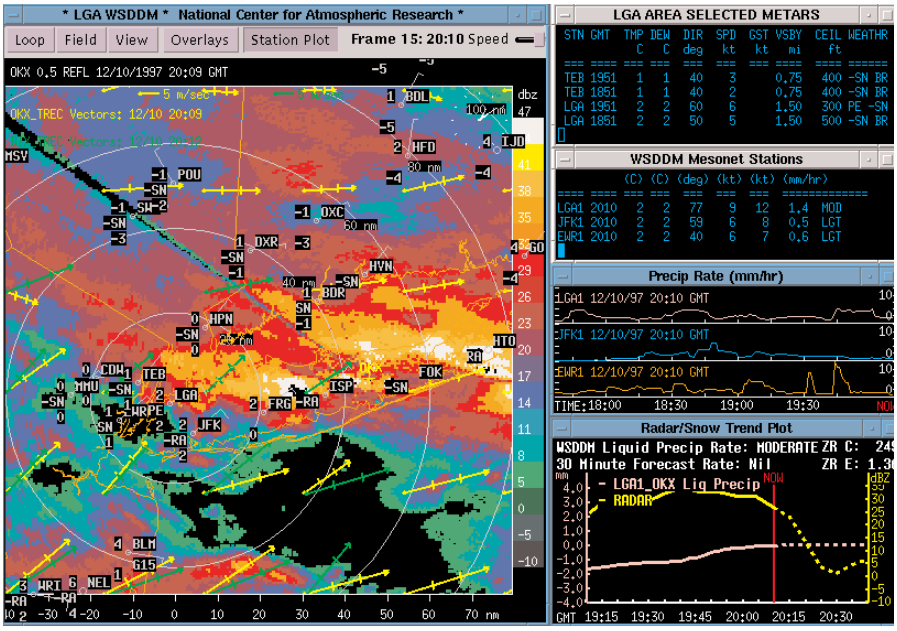
However, the research showed that large, dry snowflakes

hampering visibility are less of a threat than small, wet flakes. This important finding increased awareness that visibility alone can be misleading for deicing aircraft decisions. Another beneficial result is that WSDDM-related research has been incorporated into winter training manuals for commercial pilots. Additionally, WSDDM's accuracy is enhanced by using current and site specific weather information that results in a more accurate decision-making tool for a particular airport. The system requires little meteorological knowledge and minimal training to operate and enables decision makers to obtain valuable information in seconds.

WSDDM is a system that directly enhances aviation safety and efficiency by providing deicing decision makers and airport plowing crews with up-to-the-minute information on potentially hazardous freezing precipitation. Recent enhancements to WSDDM include an NCAR-developed Hotplate snow gauge and the implementation of wireless communications to provide weather data

to users. The advantages of the Hotplate snow gauge over the current snow gauge include: lower cost, smaller footprint, and reduced maintenance requirements.

The combination of the Hotplate snow gauge and the modern communications suite has reduced the cost of the system and increased its reliability. Finally, to increase its marketability, the FAA successfully transferred the WSDDM technology to the commercial sector for implementation. ■




View of WSSDM screen

## Aging Aircraft Conference - *continued from page 9*

JACG Principals panelists from left to right: Lt Gen Dick Reynolds; MG Larry Dodgen; RADM Bert Johnston; RADM Mark Emerson; Capt Barry Harner; BG Ed Harrington

niques can be developed.

One particularly innovative technology for detection of small cracks in precision components is thermosonic imaging. When the part being inspected is excited with ultrasonic energy, any flaws in that part will create hot-spots, which can be detected by an infrared camera. The process is easily controlled and relatively insusceptible to processing errors.

The safety of the wiring systems is also an issue of major importance. As military and commercial aircraft are used far beyond their service years, the wiring concerns have captured the attention of government and industry alike. The FAA and its academic and research partners are making critical advances in wire inspection technologies. Through international meetings, such as the Aging Aircraft Conference, researchers, aircraft maintenance professionals, and policymakers have the opportunity to address global concerns and discuss solutions for aviation's challenges. Through cooperative interchange, aviation safety is enhanced.

The 8th Joint DOD/FAA/NASA Conference on Aging Aircraft is scheduled for January 31 - February 3, 2005, in Palm Springs, CA. For additional information on this conference, http://www.agingaircraft.utcdayton.com/. ■

# International Air and Space Symposium

## *The Next 100 Years - A Look at the Future*

By any imaginable metric, the International Air and Space Symposium: The Next 100 Years was a huge success. More than 1,300 participants from over 20 countries came together July 14-17 in Dayton, Ohio, hometown of the Wright Brothers, to celebrate the technological achievements of the last century and lay the groundwork for revolutions to come.

American Institute of Aeronautics and Astronautics (AIAA) and the International Council of Aeronautical Sciences (ICAS) cosponsored the Symposium, which featured more than 500 presentations. AIAA President, Alan Mullaly, and ICAS President, Billy Fredriksson, along with the Honorable Bob Taft, Governor of Ohio, welcomed Symposium participants to Dayton at the opening ceremony, also attended by members of the Wright family and the AIAA 2003 Ambassadors. In the keynote speeches, the Honorable Robert Walker, Chair of the U.S. Commission on the Future of Aerospace, and former U.S. Representative, stated his belief that we will be different 100 years from now because we will populate the heavens and urged the U.S. to provide the leadership to create his vision. The Honorable Karl von Wagau, Member of the European Parliament, urged the nations represented to work together.

On Monday, the program focused on Commercial Aviation, with industry leaders presenting visions of future aircraft designs focused on passenger comfort and environmentally soundness. Individual technical sessions focused on a wide array of subjects, including future airports, factories, technologies, and the transport system. All speakers touched on environmental issues, which are likely to impose the fundamental limitation on commercial air transportation growth in the 21st century.

General Aviation was the focus of Tuesday. Plenary speakers reminded the audience that all aviation was general aviation in the early years. All the speakers agreed that general aviation is experiencing a rebirth at the dawn of the 21st century - we can expect many "firsts" in the next few years. Vern Raburn, President and Chief Executive Officer of Eclipse

Dr. Lourdes Maurice and Neil Armstrong

Aviation, reminded the audience that for general aviation to prosper, it must increase its reach.

The General Aviation technical sessions were the best and most comprehensive set of presentations on the subject ever assembled. Topics varied from New Roles and Missions for Tiltrotor Aircraft to Revolutionary Concepts for Personal Air Transportation.

The Wednesday program focused on Military Aerospace. The Wright Brothers' first customer was the Army Signal Corps. Since that first order in 1907, military aviation has been at the forefront of the incredibly swift advances leading to today's wondrous machines. Major General "Hap" Arnold believed that air supremacy resided in the brains and efforts of scientists and engineers, and that aviation was not a collection of airplanes, but a far and reaching vision. This remains as relevant today as in the 1930s as evidenced by the visions of the future shared by key military aviation leaders. Technical presentations on reconnaissance and surveillance systems, unmanned vehicles, and hypersonics showed that military concepts are leading the way into the 21st century.

The Symposium's final day focused on Space. The pictures sent home by the men and women who have left our planet offer a vision of a 21st century in which we can think of ourselves as citizens of Earth. The speakers showed the foundations that can make the dreams of science fiction writers and engineers, scientists and children, and indeed all of Earth's citizens a reality.

A memorable closing ceremony ended the Technical Program. Richard Russell from the Executive Office of the President of the United States provided a perspective of the highlights of the week. He challenged the audience to continue the pursuit of the fundamental advances in science and technology that define the next century of flight. Finally, in what was clearly a highlight for the attendees, Neil Armstrong, former astronaut and first man-on- the-moon, closed the program with his perspective of the future of aerospace.

All was not work in Dayton. The social program was outstanding, and

the hospitality of the Dayton community will remain a fond memory for the attendees. The Honors Night Banquet, which featured an appearance by John Travolta, who received the AIAA Foundation Award for Excellence, created attention from the national media. Everyone agreed that this Symposium, years in the making, was a highlight for the Celebration of the 100th Anniversary of Flight. The impact of its top quality presentations on the industry's next century will be tremendous. This legacy will live on in the International Air and Space Symposium; Sharing a Common Vision scheduled for April 19--20, 2004, in Washington D.C.

Dr. Lourdes Maurice, FAA's Chief Scientist and Technical Advisor for Environment and Energy, served as executive co-chair of the conference. FAA participants included: Cecilia Hunziker (Great Lakes Regional Administrator); Dr. Herman Rediess; Carl Burleson; Joan Bauerlein; Jim White; and Victoria Cox. ■

## Research Awards - *continued from page 13*

by DOD, Mil-HDBK-17 is now sponsored by the FAA. The handbook contains five volumes, the first three being polymeric composites. The 4th focuses on metal matrix composites and the 5th on ceramic matrix composites. The 6th volume is in the making and will address Sandwich Structures, replacing MIL-23.

Peter actively works on the "Purpose and Scope of the Polymeric Composites" volumes. In making the award presentation, Gerald Flanagan, who serves on the MIL-HDBK-17 Secretariat and works for Materials Sciences Corporation, said "Peter has taken a unique approach to his responsibilities at MIL-17. He finishes things. Peter was chair of a joint working group for several years. The group accomplished its planned outline and then disbanded itself. Peter then took on a Supportability Working Group. Under his leadership, this group has been steadily filling out its outline, and may soon work itself out of a job."

"Beyond being a working group chairman, Peter was active in the Guidelines Working Group and has contributed to the statistics methodology used in the handbook. If you listen to the current debates on allowables methods, you will hear frequent references to the 'Shyprykevich method.' This refers to a technique of pooling data to obtain a more statistically stable sample."

The American Institute of Aeronautics and Astronautics (AIAA) elected FAA's Dr. Lourdes Maurice to the grade of Fellow. According to the AIAA, Dr. Maurice has significantly contributed to the advancement of aerospace as a researcher, strategic leader, and program manager, while simultaneously earning three advanced degrees in separate disciplines; and tirelessly serving the professional community.

Presentation of the new Fellows took place at the International Air & Space Symposium and Exposition in Dayton, OH, last July.

Congratulations to Dr. Parimal Kopardkar for winning the 2003 NASA Ames Honor Award in the engineer category. Dr. Kopardkar joined the FAA Field Office at NASA Ames a year ago as part of the FAA/NASA Technology Transition Program.

The purpose of this program is to have FAA researchers participate early in the development of new technologies to provide the expert knowledge needed to help accelerate the development and deployment of these technologies into the National Airspace System. In his short tenure at Ames, Dr. Kopardekar has established himself as a leader in the field of human factors research relative to air traffic management.

On November 6, Insightful Corporation, a leading provider of software solutions for analysis of numeric and text data, announced that it had awarded Time Distribution Services Inc., Great Lakes Dredge & Dock, Novartis, Surromed, and the FAA's Civil Aerospace Medical Institute's (CAMI) Aerospace Medical Research Division its Insightful Innovation Award for commercial leadership in data analysis. Academic recipients included researchers from Berkeley University, Johns Hopkins University, Harvard School of Public Health and the University of Virginia.

The award recognizes CAMI's innovative foresight and accomplishment in visualizing and subsequently developing a business support system that will integrate and analyze a complex array of aerospace medical data and provide a fact-based scientific foundation for decisionmaking aimed at enhancing aerospace safety. ■

# Recertification with Distinction

## *FAA Laboratory Earns Prestigious Honor*

The Forensic Urine Drug Testing program of the FAA's Civil Aerospace Medical Institute (CAMI) has earned recertification with distinction, for a second consecutive time, from the College of American Pathologists (CAP), of Northfield, IL. This is a rare honor, and it is one made even more special because it was awarded by a national organization of working peers.

This marks the second evaluation in a row in which the CAMI laboratory earned perfect scores in on-site inspections. No deficiencies were found during the on-site inspection or in the Lab's most recent prior inspection in 2001. Both inspections included a long and detailed review of hundreds of items, including the lab's staffing, physical plant, equipment, policies, and procedures, as well as the Lab's performance on testing materials received from the pathologists' organization during the last two years.

The CAMI laboratory has long served as the primary national toxicology testing site for federal agencies, including the FAA and the National Transportation Safety Board. Testing is routinely conducted on a wide variety of biological specimens, involving both living and deceased individuals. Dennis Canfield, Ph.D., is Manager.

"Both times it was noted by the inspectors that the CAMI lab is a 'Superior' laboratory," said John Soper, Ph.D., CAP scientific director for the CAMI laboratory. "Specifically, the inspectors said CAMI performs work far beyond the capabilities of most forensic urine drug testing labs, and should be considered as a national reference lab. We are extraordinarily pleased to earn this recertification with distinction, which is recognition of the hard work our staff has long been known for."

The pathologists' Forensic Urine Drug Testing Accreditation Program reviews Laboratories that perform urine drug testing for non-medical purposes (i.e., workplace drug testing). The lab must have specific staff, resources, and procedures in place, and undergo complete periodic on-site inspections.

"Urine drug testing is not only a condition for employment, but periodic testing can be conducted on people who work as pilots, members of flight crews, or air traffic controllers," Soper said. "When specimens are available from flight crew fatalities, CAMI also conducts after-death tests on various biological samples in addition to urine."

From left to right: Mark Huggins, Dr. Dennis V. Canfield, Dr. Nicole Vu, Dr. Hua Zhu, Dr. Edward Owuor

Urine drug testing is a critical component in the efforts to fight drug abuse in this country because it can objectively identify drug users in a variety of settings. Because of the legal consequences of a positive drug test, such tests are considered "forensic" testing. Therefore, it is crucial that laboratories maintain high standards of quality assurance/quality control.

The goal of the CAP Laboratory Accreditation Program is to improve the quality of forensic laboratory services through professional peer review, education, and compliance with established performance standards. Participation in CAP review is voluntary. Laboratories earning CAP accreditation mirror Federal standards and meet the highest standards of practice.

The Civil Aeromedical Institute is the medical certification, research, education, and occupational health wing of the FAA's Office of Aviation Medicine. CAMI's work focuses on the human element in flight - pilots, passengers, air traffic controllers - and the entire human support system that embraces civil aviation. ■

## A Year of Success - *continued from page 3*

While aircraft are not a primary source of emissions resulting from fossil fuel combustion, they are the only contributor to directly deposit pollutants in the upper troposphere and lower stratosphere. Aviation is a global enterprise, and the System for Assessing Aviation's Global Emissions (SAGE) offers the unprecedented capability to vary base year inputs and operational, policy, and technology-related scenarios to assess aviation global emissions.

SAGE is a computer tool to estimate and assess aircraft emissions on a technological, operational, and geographical basis considering emissions levels through all phases of flight. At the heart of the model are technical modules, including aircraft performance, aircraft movements, capacity and delay, forecasting, fuel burn, and emissions. One typical application allows users to develop emissions inventories based upon fleet forecasts. However, the model also has the capability to estimate emissions, taking into account aircraft routing and flight trajectories, and outputting emissions levels by geographic location. The model, currently limited in use to research applications, signifies a major achievement in capturing the logistical complexities of global aviation operations.

FAA researchers also enhanced the Model for Assessing Global Exposure from Noise of Transport Airplanes (MAGENTA) to include satellite geographic information system capability to identify imagery derived land use classifications. This update provides an enhanced capability to assess the impact of development projects on numbers of people exposed to noise. Developed by the FAA and Wyle Laboratories, MAGENTA provides the capability for global assessments of aircraft noise and the impact of mitigation measures.

The MAGENTA software and its database allow estimating global noise exposure caused by civil aircraft operations. It does this by computing noise exposure contours around a large number of civil airports and counting the number of people residing within them. The model includes information on more than 1,700 civil airports that handle jet traffic and offers a landmark capability to assess global benefits of noise mitigation policy options.

In March 2003, the FAA released an upgrade to its LEDFAA (Layered Elastic Design - FAA) airport pavement thickness design software. Among the significant improvements, the new version adds the Airbus A380 and A340-500/600 aircraft families to the design aircraft library. The tool is new, faster, and is compatible with all current Windows operating systems. LEDFAA version 1.3 can be downloaded from the FAA's web site at: www2.faa.gov/arp/engineering/software.cfm. The new software can be used to design airport pavements for traffic mixes that include the new generation of super-heavy aircraft. The FAA is currently exploring the role satellite technology can play in providing communications, navigation, and surveillance to improve the capacity, efficiency, safety, and security of the NAS by providing both air- and ground-based personnel with improved real-time situational awareness of the entire flying environment. Under a FAA contract, Boeing's Air Traffic Management business unit is working with the Agency to conduct several proof-of-concept studies to demonstrate technologies that could be used by the FAA to help modernize America's air transportation system.


In February 2003, using Boeing's Connexion 737-400 demonstration aircraft, researchers tested up- and down-linked weather awareness, an aircraft deviation alerting system, and a ground display of aircraft flight data monitoring links using an onboard wireless local area network. Researchers are currently developing the demonstration plan for the FY 2004 series of flights. This next phase of the program will evaluate the surveillance data network and common information network applications.

The FAA is also working to improve public safety regarding commercial space launch vehicles by improving the methods used to analyze debris survivability. Researchers developed and are currently calibrating an acceptable method of estimating a vehicle's breakup and survivability process. The model will be used to estimate the risk posed by surviving

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## A Year of Success - *continued from page 21*

debris to the public and will allow the commercial space transportation industry to mitigate risk to the public during the launch and/or reentry of their licensed operations. The results of this research may be used to define space vehicle flight corridors that adequately protect the public from commercial space transportation operations. In FY 2003, researchers completed a draft document for use by the FAA and industry to perform a first-hand estimation of the expected casualty for a given mission.

In early 2003, FAA's Civil Aerospace Medical Institute (CAMI) worked with the National Academy of Sciences National Research Council to establish a post-doctoral research associate program in support of FAA commercial space research activities. FAA selected its first post-doctoral scholar who is studying the "Minimum Requirements for Environmental Control and Life Support System (ECLSS) on Manned Commercial RLVs." This research effort supports safety work being done by the FAA's Office of Commercial Space Transportation to understand better the limits of reusable launch vehicle equipment.

CAMI's vision researchers conducted a study to evaluate the vision requirements for persons maintaining and inspecting aircraft. Frequently recurring inspections and maintenance are crucial for ensuring that aircraft and engines are kept in safe operating condition. This research will form the basis for the development of a uniform vision standard for person nel performing these duties. In FY 2003, the research team completed the survey phase of the Vision Standards Study. The Team conducted surveys at 9 aircraft maintenance facilities and developed a vision task analysis and demographic profile of aircraft inspection and maintenance workers. Depending on the age of the workers, a vision screen was proposed.

FAA researchers also further refined the Human Factors Analysis and Classification System (HFACS). This is a theoretically based tool for investigating and analyzing human error associated with aviation accidents and incidents. Previous HFACS research has shown that this system can be used to analyze the underlying human factors causes of both commercial and general aviation accidents. Furthermore, these analyses have helped identify general trends in the types of human factors issues and aircrew errors that have contributed to civil aviation accidents.

In FY 2003, researchers used HFACS to determine the global human error categories associated with aviation accidents. They developed a detailed analysis of each of the different error forms (decision, violations, skill-based, and perceptual errors) to determine the exact nature of their genesis and relative importance in the causal sequence of events. As in previous studies using HFACS analysis, researchers found that skill-based errors are consistently the most common error leading to a general aviation accident, and, in most cases, is the precipitating error form as well. Further-more, when violations are associated with a general aviation accident, they are more likely to result in a fatality.

Current FAA policy allows pilots to complete 10 hours of instrument training using an approved personal computer aviation training device. FAA researchers are comparing the effectiveness of Personal Computer Aviation Training Device (PCATD) against training and performance in an aircraft. As part of this effort, human factors specialists used an incremental transfer of training research design to measure the effectiveness of a flight training device (FTD) and a PCATD to determine the point at which additional training in a FTD or a PCATD was no longer effective. The collected data will enable certification personnel to determine what credit to award for different classes of flight training devices within an instrument training curriculum. Preliminary results suggest that flight training devices and personal computer aviation training devices are effective, however definitive statements cannot be made until the sample has been completed.

We look forward to even greater accomplishments in Fiscal Year 2004. I invite you to visit our website (http://research.faa.gov) and read the quarterly FAA *R&D Review* to keep apprised of our ongoing work. ■

# Back to the Future

## *Rethinking Airport Technology Research*

The FAA is pleased to announce the 2004 Worldwide Airport Technology Transfer Conference – *Back to the Future: Rethinking Airport Technology Research* is now scheduled to take place April 18-21 at the Hilton Atlantic City Hotel and Casino in Atlantic City, New Jersey. Co-sponsored by the FAA, the American Association of Airport Executives, the American Society of Civil Engineers, Airline Pilots Association, Airport Consultants Council, Airport Council International-NA, American Concrete Pavement Association, Asphalt Institute, and Helicopter Association International, this international conference will focus on the development of technology and its application to airports.

The conference will cover a broad range of technology areas divided into two technical tracks: Airport Pavement and Airport Safety. The conference will showcase the FAA National Airport Pavement Test Facility, built in partnership between the FAA and Boeing. This conference will provide a unique opportunity to both the aviation industry and the research community to interact and exchange information to assure safe and efficient airport operation. The conference will include plenary sessions with internationally recognized keynote speakers, technical presentations, exhibitions, tours of the FAA William J. Hughes Technical Center, and a site visit to the National Airport Pavement Test Facility.

For additional information on the conference or for information on how to submit a paper, please visit, http://www.airtech.tc.faa.gov/naptf/att04/. ■

# Airborne Internet/Collaborative Information Environment

## *Network in the Sky*

The Airborne Internet/Collaborative Information Environment (AI/CIE) development program is working to provide a general purpose, multi-application data channel to aviation. When fully operational, it has the potential to provide significant cost savings for aircraft operators and the FAA, since it allows the consolidation of many functions into a common data channel. A primary application for the AI/CIE is to track aircraft for the air traffic control system, but the data channel can be used for myriad other applications. The applications available are only limited by the bandwidth available.

The AI/CIE research program began as a joint FAA/NASA effort to support NASA's Small Aircraft Transportation System (SATS) program. But there is no reason to limit the AI/CIE to SATS-class aircraft, because all of aviation, and even transportation, can benefit from this technology.

According to Ralph Yost, in the Innovations Research Division at the FAA's William J. Hughes Technical Center, "The principle behind the Airborne Internet/CIE is to establish a robust, reliable, and available digital data channel to aircraft. Establishing the general purpose, multi-application digital data channel connection to the aircraft is analogous to the connection of a desktop computer to its local area network, or even the wide area network we call the Internet. But aircraft are mobile objects. Therefore, mobile routing is required to maintain the data channel connectivity while the aircraft moves from region to region."

The desktop computer, whether used in the office or the home, runs many different applications that can all use the same data channel. The applications are designed around the Internet Protocol (IP) standard to take advantage of the existence of the network connection to the computer. AI/CIE is built upon the same model. It will provide a general purpose, multi-application data channel that numerous applications can use. By combining application and data functionality over a common data channel, aviation has the potential to significantly reduce costs for equipage on the ground and in the aircraft. "If aircraft used networked computers, a whole new set of operating

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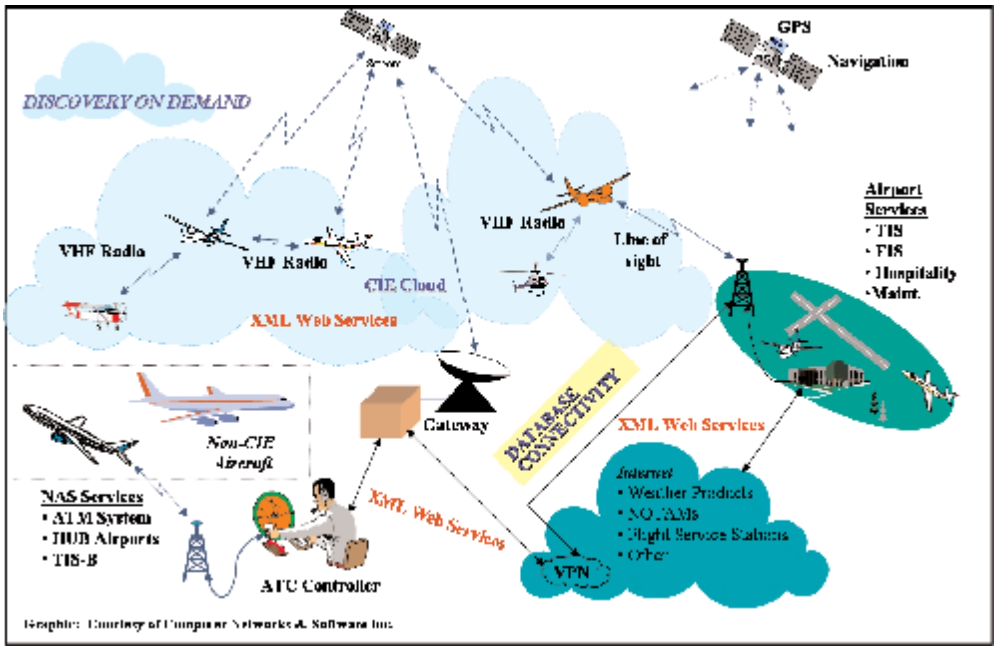
## Airborne Internet - *continued from page 23*

Airborne Internet/Collaborative Information Environment (AI/CIE)




capabilities, cost savings, safety, and efficiency for tomorrow's aviation industry could be enabled. The functions provided today that require the use of multiple on-board systems could be reduced to two simple systems," explains Yost.

First, a rigorous and dependable method to maintain the airplane's connection to the ground-based network is needed. This function is feasible using a combination of very high frequency (VHF) radio, used for today's aircraft communications, and an alternate, backup communication method. A satellite communication system could be employed for aircraft that fly in sparsely populated areas that are beyond VHF coverage of the existing national airspace system (NAS) infrastructure, or for any aircraft that might lose VHF coverage, even temporarily. Satellite communication is being used for trans-oceanic flight today in which aircraft are clearly beyond range of the VHF radio system in the NAS.

Second, a means of accurately determining an aircraft's position is required. Current technology in GPS receivers provides position information reliably and accurately. Wide-Area Augmentation System (WAAS) and Local Area Augmentation System (LAAS) are aviation systems that use Global Positioning System (GPS) and provide error correction to allow aircraft the accuracy needed for navigation and landing.

By combining the GPS provided position information of any moving aircraft (or other vehicle) with reliable mobile network connectivity, the aircraft's position could be constantly reported to the ground network for processing. Further, this data could provide position and tracking information back to aircraft so the flight crew could be aware of other aircraft movement in its proximity. Air-to-air position reporting is also possible using technologies such as Automatic Dependent Surveillance-Broadcast (ADS-B).

When fully developed, it is possible that enough aircraft could use the AI/CIE architecture to create a virtual network in the sky. Information retrieval could be accomplished using XML Web Services, which would provide a seamless flow of information from many sources. At any given moment, there are between 4,500 and 6,000 aircraft in flight over the United States. Air transport aircraft could not only use the AI/CIE for their own purposes, but they could provide a network router function that could sell excess bandwidth to other less bandwidth-demanding aircraft.

By using the Collaborative Information Environment model, aircraft operations and services could be conducted more efficiently. Our society is increasingly demanding information connectivity, even while traveling.

This network in the sky not only reduces equipage and saves system costs, it could create a revenue stream for air carriers that does not currently exist. It becomes a win-win situation for aviation.

For more information, please visit, http://www.AirborneInternet.com. ■